

T CARRIER RESTORATION CONTROL PLAN

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1. GENERAL	
1.01 This section is issued to:	
(a) Provide a plan for the rapid restoration of T carrier systems that have failed due to trouble in the repeatered line.	(g) Job titles used throughout this practice are not intended to imply that jobs are sex-restricted. No jobs at Pacific Northwest Bell are restricted to either males or females.
(b) Define the responsibilities of the T carrier system and span line control offices, T carrier restoration control center (TRCC), Construction, Plant service centers (PSC) and Engineering in administering the plan.	1.02 Refer to the following Bell System Practices for more information on this subject. 002-502-900PN, Plant Emergency Reports 010-300-010, Controlled Maintenance Plan 010-300-011, Equipment Test List — Instruction 365-000-010, T Carrier System — Terminal and Repeatered Line Central Office Record Cards 365-221-500, T Carrier System — Repeatered Line — Initial and Preinstallation Tests 365-226-500, T Carrier System — Repeatered Line Identification Plan and Spare Line Patching 365-110-500, T Carrier System — Maintenance & Trouble Location Procedures 365-225-500, T Carrier System — Repeatered Line — Maintenance Test 365-227-100, T Carrier System — Repeatered Line — Fault Locating Procedures 365-320-100, T Carrier System — Order Wire Facilities Description 632-800-961PN, Cable Maintenance — Cable Failures — Restoration of Toll Facilities 634-020-501, Cable Testing — General Rules for Using Identification Tone 634-020-502, Cable Testing — Detecting Tone With an Amplifier 634-040-500, Cable Testing — General Rules For Establishing Talking Circuit 634-040-502, Cable Testing — Talking Circuit with 76 Type Test Set 634-040-503, Cable Testing — Talking Circuit with Cableman's Talking Set (84A or D161013 Test Set)
(c) Provide for standard operating procedures to prevent service interruption.	
(d) Outline maintenance and backbone line procedures.	
(e) Outline identification and protection procedures.	
(f) Outline the responsibilities and procedures for T carrier cable restoration.	



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634-200-501, Cable Testing — Identifying Conductors — 76 Test Set

634-200-502, Cable Testing — Identifying Conductors with Cableman's Talking Set (84A or D161013 Test Set)

634-200-511, Cable Testing — Identifying Conductors in Long Cables

634-200-520, Cable Testing — Pair Identification Using the AT-8121, L1A Test Set

640-525-106, T Carrier System — 466 and 468 Type Apparatus Cases — Description

640-525-215, T Carrier System — Installation and Replacement of Repeaters

640-525-220, T1 Carrier — Pair Loss Measurements in Repeater Sections

2. BACKBONE AND MAINTENANCE LINES

2.01 The TRCC will determine the requirements for and routing of all backbone and maintenance lines. These lines using bridging repeaters will be established as assigned on circuit layout cards issued by the Toll Service Supervisor's office. See Fig. 1 through 6 for cross-connections.

2.02 Maintenance lines are wired as in Figures 1, 3, 4 and 6. The control office wiring Fig. 1 and 4, provides a termination and a signal source. Noncontrol (end) office wiring, Fig. 3 and 6, provides a loop-around.

2.03 Backbone lines are wired as shown in Fig. 1 through 6. Intermediate offices use the layout in Fig. 2 or 5; noncontrol (end) offices use the layout in Fig. 3 or 6; and the control offices use the layout in Fig. 1 or 4.

3. DEFINITIONS

3.01 **Control Office:** The office designated as system or span line control on the circuit layout cards.

3.02 **Noncontrol Office:** The distant office as indicated on circuit layout cards.

3.03 **Intermediate Office:** An office having an office repeater on a system or backbone line that does not terminate in that office.

3.04 **Side System:** The system using the other side of a repeater on a two (dual) cable span.

3.05 **Span Line:** The combination of line repeaters including the office repeaters and cables between two adjacent offices.

3.06 **Maintenance Lines:** Spare repeated lines between two adjacent offices. These lines are set aside for routines or restoration as administered by the TRCC.

3.07 **Backbone Lines:** A combination of spare repeated lines "wired through" intermediate offices. These lines are set aside for terminal to terminal system restoration as administered by the TRCC.

4. PROTECTION AND IDENTIFICATION

4.01 All offices provide protection for all repeaters by placing 10-type signal plugs in the IN, OUT, X, R, or L jacks. These plugs are removed only for patching or testing.

4.02 The plugs are color coded and designation strips should be color coded to match. The following colors and plugs are used:

Backbone Lines	10A — Red
Maintenance Lines	10E — Yellow
Unassigned and Vacant Lines	10E — Yellow
Bridging Repeaters	10D — Green
One Cable System	10B — White
Two Cable System	10C — Blue

Note: These plugs are ordered nonstock from Western Electric Co.

5. RESPONSIBILITIES

T Carrier Restoration Control Center

5.01 The T carrier restoration control center (TRCC) has overall control of all backbone and maintenance lines and is responsible for administration and coordination.

5.02 When informed of a system failure due to span line trouble, the TRCC will:

- (a) Issue a case number and assign a backbone or maintenance line for restoration. This case number will be used as authorization to patch.

(b) Indicate all offices at which patching will be required and direct and coordinate all patching operations.

(c) Initiate Plant Emergency Report. See Section 002-502-900PN.

(d) Follow-up to ensure that:

(1) When a backbone line is broken, the unused sections have pulses and a termination applied from the appropriate offices per Fig. 9 or 13.

(2) The *system control office* reports within four hours (after restoration of failed system) the location of the defective span line.

(3) The *span control office* has reported the fault location, cleared the trouble, and returned the system to its regular facilities within one working day.

Note: At the discretion of the TRCC supervisor, problems not cleared or located within the time specified in items (2) and (3) may be referred to progressively higher levels of management at 4-hour intervals until the problems are cleared.

(e) Maintain an accurate log on all system failures.

(f) Maintain the status of all backbone and maintenance lines.

(g) Analyze system failures for trouble patterns.

(h) Keep an updated file of all system, span, backbone and maintenance line layout records.

(i) Request the rearrangement and/or addition of backbone and maintenance lines as growth and requirements change.

All Offices

5.03 When a system failure occurs, all offices must observe the following:

(a) Do not perform any patching or restoration unless the office requesting a patch has an authorizing case number issued by the TRCC.

(b) Use bridging repeaters for restoration and maintenance in-service patching as per Fig. 7 through 13.

(c) Tag all patches with a Form E-5132-W. See Section 660-301-010.

(d) Prepare trouble ticket E-5840. See Section 010-300-010.

(e) Use a bridging repeater (201C or 206C) to apply quasi-random signals or use a pulse source on all maintenance, vacant, unassigned backbone lines. This will prevent free running repeaters from interfering with fault location procedures. Also, terminate the receive end of all maintenance, vacant and unassigned lines with a 100-ohm resistor. See Fig. 1 through 6.

(f) Keep the TRCC informed of the status of all trouble locating and clearing proceedings.

(g) Notify the TRCC promptly of any activity affecting T carrier, ie, cable trouble, splicing operation, gas pressure alarms, repeater additions or replacements, etc.

(h) Perform all tests per Section 365-225-500 to verify that the defective span has been properly repaired.

(i) Answer T carrier cable order wire promptly and maintain contact with cable maintenance forces during any operation affecting T carrier, ie, repeater addition or replacement, splicing operation, etc.

System Control Offices

5.04 The system control office has the overall responsibility of restoring the failed system promptly to service. In addition to the responsibilities in 5.03, the system control office must:

(a) Promptly inform the TRCC by name and number of a system failure due to span trouble.

(b) Obtain a case number and a backbone or maintenance line from the TRCC for system restoration or routine.

(c) Expedite and direct patching procedures for restoration and the removal of patches when span troubles have been cleared. See Fig. 7 through 13.

- (d) Initiate testing and isolate the defective span. The TRCC must be notified of which span is defective within four hours.
- (e) On system failures due to fuses, power supply, etc, notify the TRCC of system name, number, trouble and duration after system has been returned to service.

Noncontrol and Intermediate Offices

5.05 In addition to the responsibilities in 5.03, the noncontrol and intermediate offices will:

- (a) Perform all restoration patching promptly and properly as directed by the system control office or TRCC.
- (b) Maintain contact with the control office during any patching operation.

5.06 In addition to the responsibilities in 5.03, the span control office will:

- (a) Perform fault locating tests promptly per Section 365-227-500 when informed by the system control office or TRCC of a defective span.
- (b) Notify TRCC promptly when defective repeater or cable pairs have been isolated.
- (c) Remove power before and during the replacement of defective repeaters.
- (d) Perform tests per Section 365-225-500 to ensure defective span was properly repaired. Notify TRCC promptly when trouble is clear.
- (e) Maintain contact with cable maintenance forces during any operation affecting T carrier, ie, repeater changeout, addition, splicing, etc.

5.07 In addition to the responsibilities in 5.03, the maintenance line control offices will:

- (a) Perform restoration or maintenance patching as directed by TRCC or system control office.
- (b) Maintain contact with the system control office during any patching operation.
- (c) Perform tests on maintenance lines daily per Section 365-225-500 and inform TRCC of test results and status.

Construction

5.08 T carrier cable maintenance forces must:

- (a) Respond promptly as dispatched by the Construction management control or TRCC to clear T carrier span troubles.
- (b) Contact via order wire the span control office or TRCC before opening any apparatus case. Contact must be maintained during the work operation and until the apparatus case is closed and the span line has been tested.

Note: All replacement repeaters must be tested using a 315A Sierra, 7002 Northeast Electronics or J98710H test set before installation. Also, the defective repeater must be tested to verify that it was defective. See Section 365-221-500.

- (c) Construction management control or the cable department must *notify the TRCC 24 hours in advance* and provide the job number of any work operation in cable containing T carrier.

Plant Service Centers

5.09 PSCs will notify the TRCC when:

- (a) A sheath opening number is issued on cables containing T carrier. The PSC will provide the TRCC with the opening and job number, pairs involved, location and splicer's mobile, Bellboy or Page Boy number.
- (b) Trouble occurs in any cable or sheath containing T carrier.

Engineering and Circuit Layout - Carrier

5.10 Engineering will provide and circuit layout will assign spare repeatered lines in each span for restoration and maintenance. Lines will be assigned as follows:

- (a) *Single Cable Span: 206-Type Repeater Bay*
 - (1) *Initial Apparatus Case:* Provide two spare lines, slots 12 and 25. Equip office repeaters and assign mountings as follows:
 - a. Slot 25 to office mounting slot 12 on even numbered shelves, ie, 2, 4, 6, etc. Use adjacent slot 13 as bridging repeater.

- b. Slot 12 to office mounting slot 12 on odd numbered shelves, ie, 1, 3, 5, etc. Use adjacent slot 13 as bridging repeater.
- (2) **Second Apparatus Case:** Provide 1 spare line in second apparatus case, slot 25. Assign office mounting slot 12 on even numbered shelves, ie, 4, 6, 8, etc. Use slot 13 as bridging repeater on even numbered shelves, ie, 4, 6, 8, etc. Release spare span assignment in first apparatus case slot 12 in b above.
- (b) **Single Cable Span: 201-Type Repeater Bay**
 - (1) **Initial Apparatus Case:** Provide two spare lines, slots 12 and 25. Assign to office mountings slot 1 on shelf 5. Use adjacent slot 2 as bridging repeater. Assign side 1 to spare case slot 25 and side 2 to spare case slot 12.
 - (2) **Second Apparatus Case:** Provide one spare line in second apparatus case slot 25. Use office mounting and bridging repeater of slot 12 in first span. Release spare assignment.
 - (3) As additional apparatus cases are installed within a span, provide spare lines as in (a) and (b) above until a total of six spares are provided in any one span.
- (c) **Dual Cable Spans:** Two spare span lines will be provided (both directions of transmission) in each of the first three apparatus cases, slot 25, sides 1 and 2.
- (d) **Dual Cable Spans: 206-Type Repeater Bay**
 - (1) Assign apparatus case, slot 25, sides 1 and 2 to office mountings slot 12 on even numbered shelves, ie, side 1 to second shelf and side 2 to fourth shelf. Use adjacent slot 13 as bridging repeater.
- (e) **Dual Cable Spans: 201-Type Repeater Bay**
 - (1) Assign apparatus case, slot 25, sides 1 and 2 to office mounting slot 1, sides 1 and 2 on shelf 5. Use adjacent slot 2, sides 1 and 2 as bridging repeater.

6. SYSTEM FAILURE - RESTORATION PROCEDURES

Note: The patching procedures to restore a failed system are outlined in Fig. 7 through 13. These procedures, used with the bridging repeater, are the only acceptable method for making restoration patches.

- 6.01 The procedures in this part will apply when systems have failed due to a defective repeater or cable pair.

Procedures

- 6.02 The system control office will notify the TRCC of the system name, number and time of failure.
- 6.03 The TRCC will issue a trouble case number and assign for restoration the following:
 - (a) A maintenance line if the failed system consists of a single span.
 - (b) A backbone line if the failed system is a multispan system.
- 6.04 The system control and noncontrol offices will complete patches to restore the system to service, will prepare trouble tickets and will tag all patches.
- 6.05 Multispan system: The control office, after restoration, will expedite testing with intermediate offices to determine which span is defective. The control office will notify the TRCC promptly or provide a status report if trouble locating exceeds four hours.
- 6.06 At the discretion of the TRCC, the defective span may be patched to a maintenance line thereby releasing the backbone line.
- 6.07 At the request of the TRCC, the span control office will conduct fault locating tests and report the trouble location within one hour.
- 6.08 The TRCC will notify the construction management control or cable maintenance forces of trouble location, repeater type, networks, power options, apparatus case and slot number. Repair forces will be dispatched promptly as span line troubles **must be cleared** within one working day.
- 6.09 Upon reaching the trouble location, the cable maintenance personnel will contact the span control office or TRCC and verify the trouble report.

6.10 The plant maintenance forces must verify that the power has been removed before a repeater is removed and replaced. They then must maintain contact during repeater change out and until the span control office has tested the span.

6.11 Span control will notify the TRCC when troubles are cleared.

6.12 TRCC will contact system control which will direct the removal of patches and return the system to its normal working facilities.

7. CABLE FAILURE - RESTORATION RESPONSIBILITIES

7.01 To locate the fault and identify and restore T carrier pairs, use the same methods and equipment used for other paired and quaded cable. (See the sections listed in 1.02.)

Note: All T carrier offices (control or noncontrol) must immediately report the failure of any T carrier immediately to the TRCC. Only with complete information can the rerouting of failed systems or cable restoration begin.

7.02 The TRCC will:

- (a) Assume overall control and coordinate all efforts of system reroute and restoration.
- (b) Determine priorities of system restoration.
- (c) Immediately alert the cable maintenance forces of the cable failure and the trouble location (if known).
- (d) Notify the Trunk Assignment Bureau if trunk pairs are involved.
- (e) Initiate a Plant Emergency Report.

7.03 The span Control Office will: (See Caution.)

- (a) Notify the TRCC immediately of any T carrier cable failure.
- (b) Expedite trouble location tests. If necessary, have the PSC make Wheatstone bridge measurements to determine trouble location.
- (c) When known, inform the TRCC immediately of trouble location, pairs and systems involved.

(d) During restoration, establish and maintain contact with the cable maintenance forces and span noncontrol office via the order wire.

(e) Direct cable restoration using the priorities as provided by the TRCC.

(f) Tone and identify defective pairs from the MDF using a 76 or similar test set.

(g) Notify the TRCC as T carrier pairs are repaired, powered and tested.

(h) Keep the TRCC informed of all restoration proceedings and events.

Caution: The span control must verify that all power feeds (both ends) have been removed on each defective T carrier pair before beginning any testing or restoration work. In partial cable failure, adequate precaution and protection must be used to avoid removing power from working systems.

7.04 Cable maintenance forces will:

- (a) Assume control of field restoration procedures.
- (b) Dispatch and provide adequate field personnel and test equipment to perform cable restoration.
- (c) During restoration, establish and maintain contact with the span control and noncontrol offices via the order wire.
- (d) Tone and identify the defective T carrier pair at the apparatus case. Use a 162A adapter and 76 or similar type test set.
- (e) Verify that power has been removed from defective pairs before beginning any restoration work.
- (f) Notify the TRCC of the extent of damage and approximate restoration time. The Construction Supervisor is responsible for notification.

7.05 Plant service center will:

- (a) Perform Wheatstone bridge measurements on defective pairs as requested by the span control or TRCC.

7.06 System control office will:

- (a) Notify the TRCC of all system failures.
- (b) Assume control of and direct all restoration patching of failed systems on reroutes as provided by the TRCC.
- (c) Inform TRCC as systems are tested and returned to service.

7.07 Trunk Assignment Bureau will:

- (a) If requested by the TRCC, provide all special service and private line circuits assigned to trunk pairs by priority and pair assignment.

8. CABLE FAILURE — RESTORATION PROCEDURES

8.01 In case of a system failure the cable restoration and trouble testing procedures in this part will apply.

Note: Since, in most failures, resistance measurement cannot be made beyond the first apparatus case, the span control office may usually have the plant service center conduct Wheatstone bridge measurements. Measurements should be made on defective pairs providing service other than T carrier, ie, the order wire, fault locating line, interoffice trunks, private lines, etc.

Procedures

8.02 The span control office will inform the TRCC of the trouble location immediately after tests have been completed.

8.03 A talk line must first be established between the trouble location span control and noncontrol offices. If possible, the order wire should be used.

8.04 Two general conditions will be encountered in the identification and restoration of the T carrier pairs.

- (a) Between apparatus cases: Identifying tones must be sent from the two adjacent apparatus cases to the trouble location on the defective T carrier pairs.
- (b) Between apparatus case and central office: Tones must be sent from the central office and the first apparatus case to the trouble location. All tones will be sent using a 76 or similar type test set. From the apparatus case, use a 162A adapter with the set.

8.05 With the priorities provided by TRCC, the span control office will direct the restoration of the defective pairs. Normally T carrier pairs will be restored first, but special service circuits may change this priority.

8.06 As pairs are restored and tested, the span control office will notify the TRCC. They will inform each control office to return their systems or circuits to service.

Rerouting — Procedures

8.07 Rerouting failed systems will be accomplished via backbone, maintenance and equipped vacant lines, or by turning down systems with lower priorities and using their facilities. It may not be possible to reroute all failed systems. For example, rerouting to end offices is not possible.

8.08 The TRCC will determine all reroutes and priorities.

- (a) The TRCC will contact the system control offices assigning case numbers, backbone, maintenance or vacant lines and will indicate those offices where reroute patches will be required.
- (b) Each system control, with the information provided by TRCC, will direct the patching to restore its systems.
- (c) When permanent repairs have been completed, the TRCC will direct system control to remove all patches on rerouted systems.

9. ORDER WIRES

9.01 A subscriber's line must be "wired to" each individual T carrier span line order wire. The office (usually control) designated on the span line circuit layout card (E4941, line G) to provide SD97085-01, Fig. 101, is the office responsible for preparing a Form M149, Official Communications Request (see C.I. 34/P.I. 980.00). The M149 is a request to assign the subscriber's line to the order wire.

10. ANALYSIS AND REPORTS

10.01 The TRCC will review the T carrier tickets and logs to develop patterns of:

- (a) Span line troubles
- (b) Terminal equipment failures
- (c) Individual apparatus cases
- (d) Training needs

10.02 The TRCC will prepare a monthly report for the General Plant Operations Office and each division office providing the following information:

- (a) System name and number, trouble cause, duration and remarks.
- (b) Total number of system failures and outage time per failure.
- (c) Individual span line failures, trouble causes, duration and remarks.
- (d) Total number of span line failures and outage time per failure.
- (e) Total number of repeater failures — office or line.

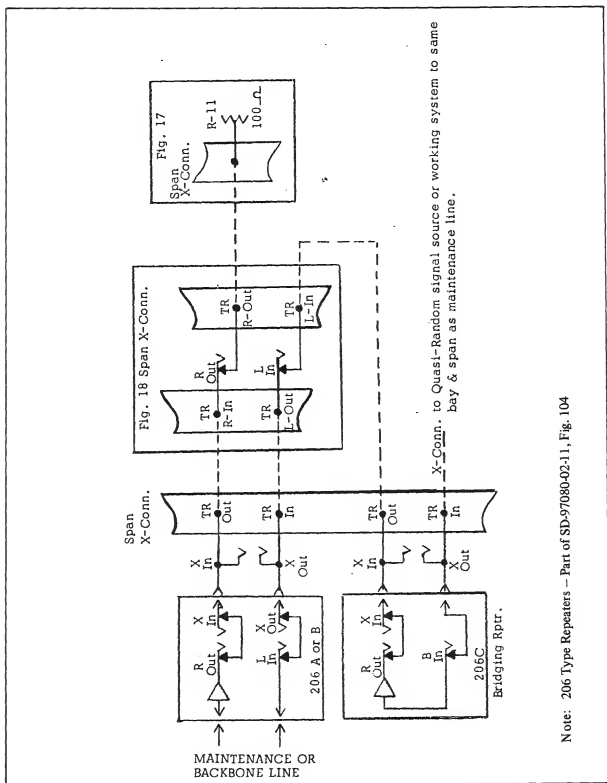


Fig. 1 - Cross Connections for Applying a Signal Source and Terminating Backbone and Maintenance Lines

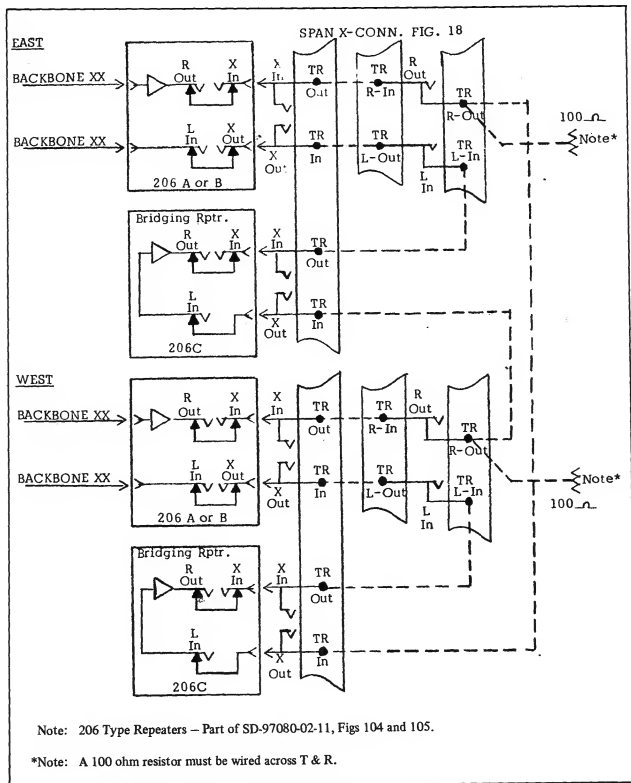
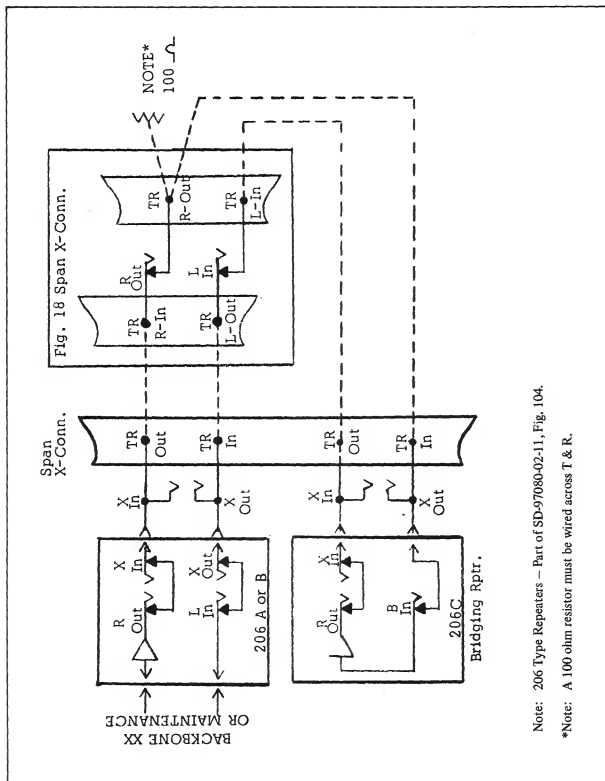


Fig. 2 – Cross Connections for Backbone Lines at Intermediate Offices



Note: 206 Type Repeaters - Part of SD-97080-02-11, Fig. 104.

*Note: A 100 ohm resistor must be wired across T & R.

Fig. 3 - Loop Around Cross Connections for End Offices on Backbone and Maintenance Lines

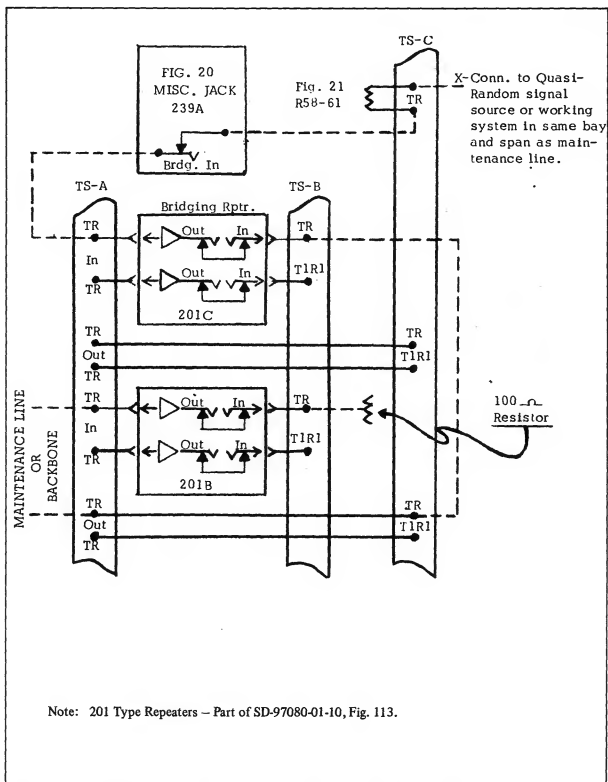
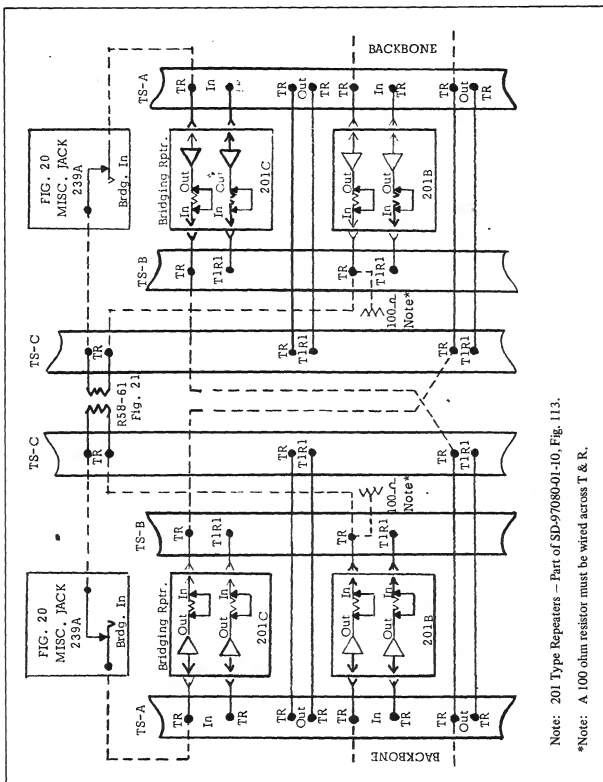


Fig. 4 – Cross Connections for Applying A Signal Source and Terminating Maintenance and Backbone Lines



Note: 201 Type Repeaters - Part of SD-97080-01-10, Fig. 113.

*Note: A 100 ohm resistor must be wired across T & R.

Fig. 5 - Cross Connection for Backbone Lines at Intermediate Offices

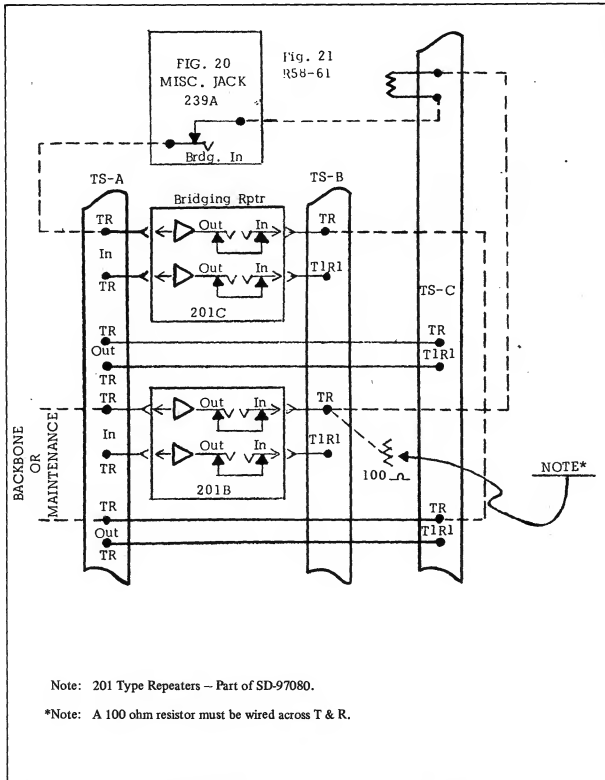


Fig. 6 – Loop Around Cross Connections for End Offices on Backbone and Maintenance Lines

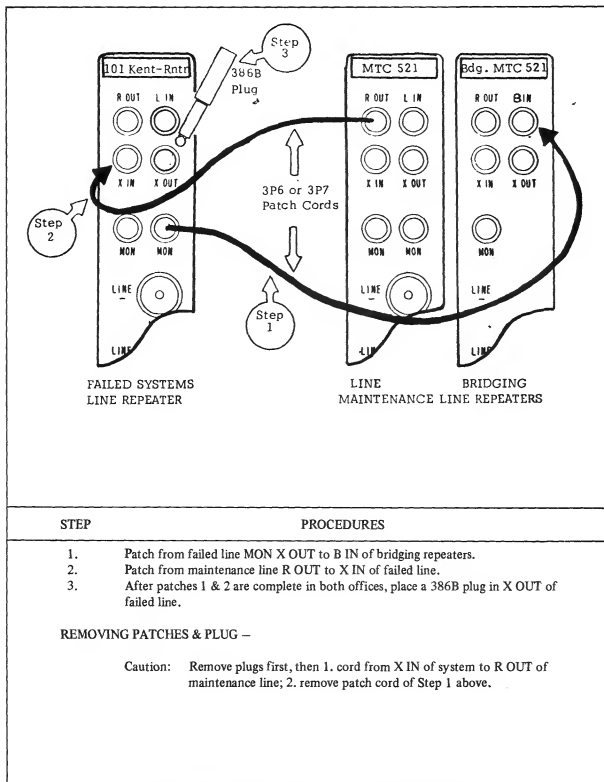
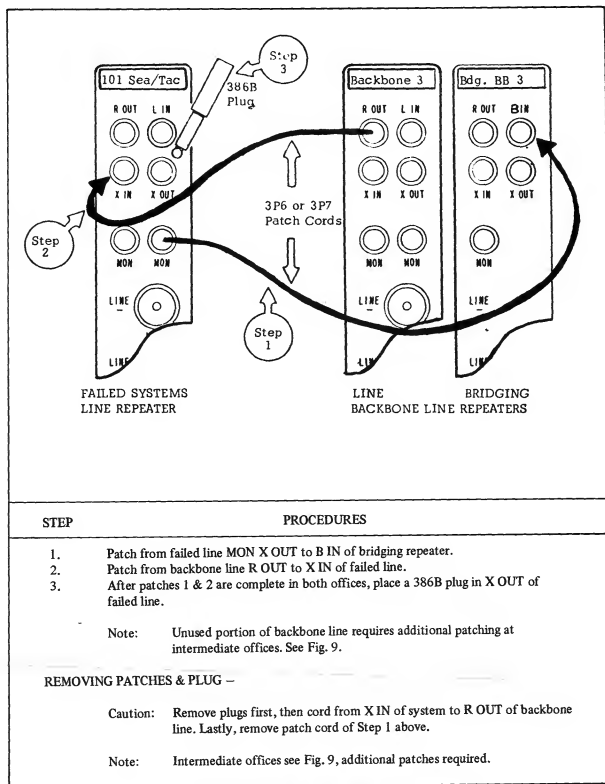


Fig. 7 — Maintenance Line Patching — 206 Type Repeaters



**Fig. 8 — Backbone Line Patching — 206 Type Repeaters
Intermediate and Terminal Offices**

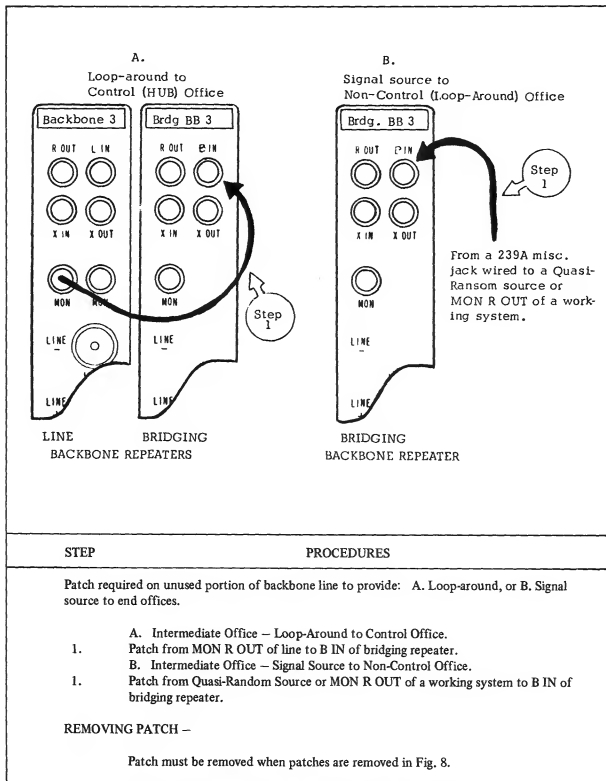


Fig. 9 – Backbone Line Intermediate Office – 206 Type Repeaters

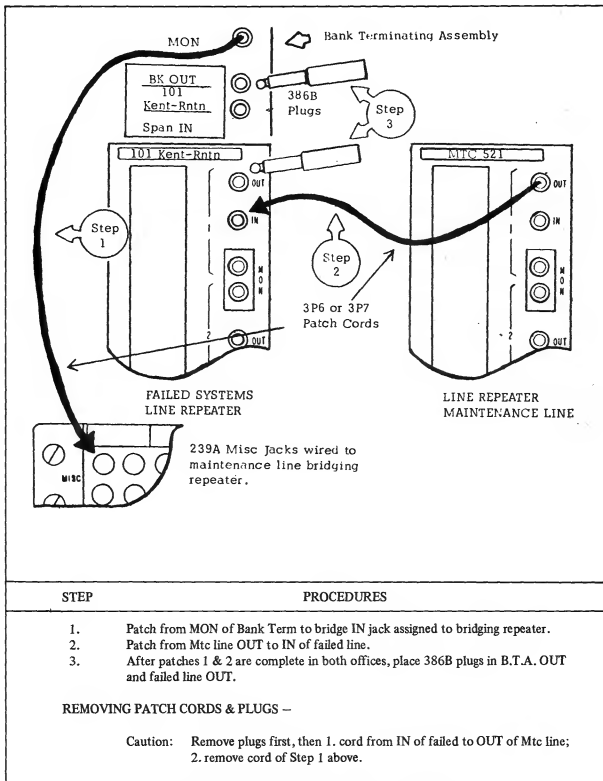
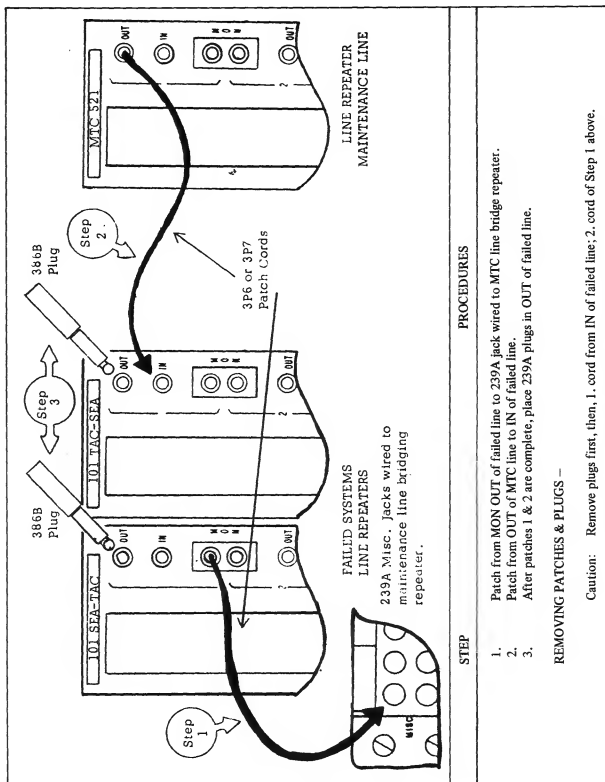


Fig. 10 - Maintenance Line Patch - 201 Type Repeater
Terminal Office



PROCEDURES

1. Patch from MON OUT of failed line to 239A jack wired to MTC line bridge repeater.
2. Patch from OUT of MTC line to IN of failed line.
3. After patches 1 & 2 are complete, place 239A plugs in OUT of failed line.

REMOVING PATCHES & PLUGS -

Caution: Remove plugs first, then, 1. cord from IN of failed line; 2. cord of Step 1 above.

Fig. 11 - Maintenance Line Patch - 201 Type Repeaters
Intermediate Office

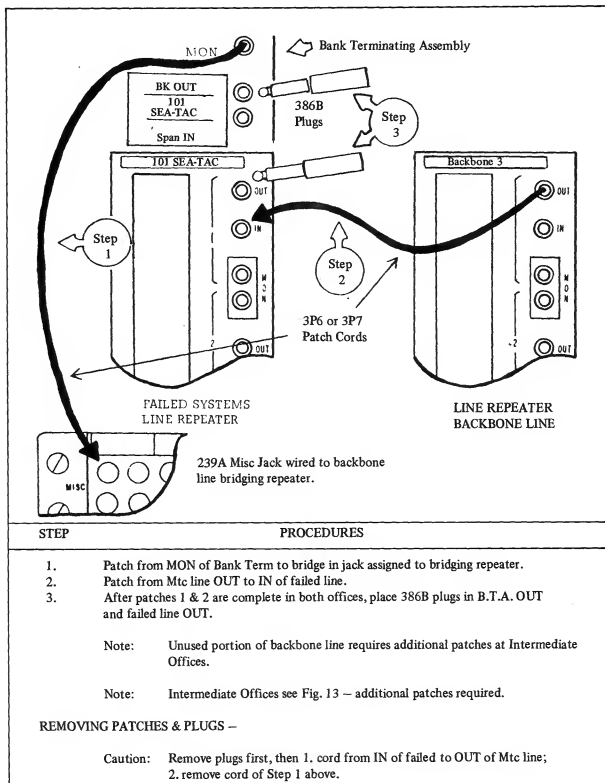


Fig. 12 – Backbone Line Patches – 201 Type Repeaters
Terminal or Intermediate Offices

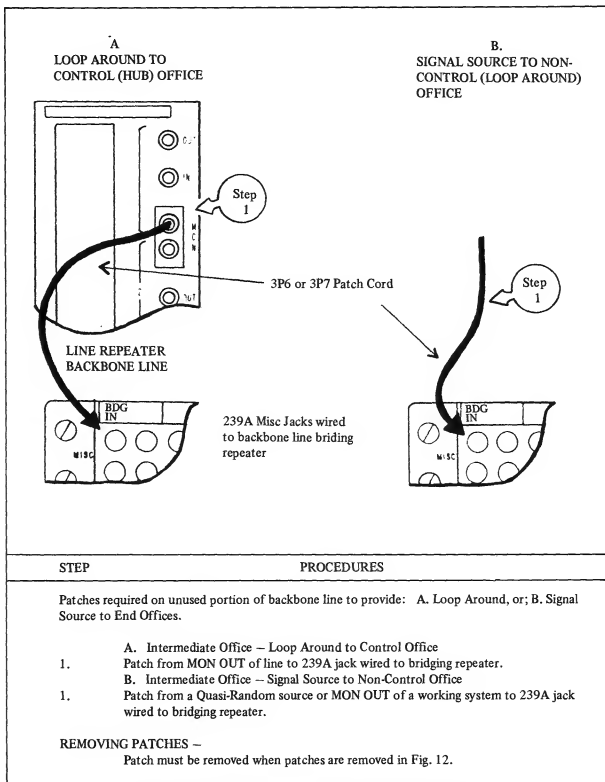


Fig. 13 – Backbone Line Intermediate Office – 201 Type Repeaters

